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TREE GROWTH AND CLIMATE

A. E. DOUGLASS. **Climatic Cycles and Tree-Growth: A Study of the Annual Rings of Trees in Relation to Climate and Solar Activity.** 127 pp.; diagrs., ills., bibliogr. *Carnegie Instn. Publ. No. 289.* Washington, D. C., 1919. 10 x 7 inches.

In 1901 Professor Douglass began a study of tree growth which bids fair to be one of the most fruitful sources of information as to climate. His method, which is already widely known, consists of measuring the width of the annual rings of growth and thereby determining the climatic conditions. Beginning with the pine trees near Flagstaff Observatory in Arizona, where he was then at work, he has carried his observations to the Pacific and to the Atlantic coasts, and to many countries of Europe.

In the present volume Professor Douglass sums up all his work to date (compare the abstract on p. 190 of this *Review*). He rightly devotes much space to a careful description of the methods which he has gradually evolved. How delicate those methods are may be judged from his ability to identify rings of growth. Even if he knows nothing as to the date of a piece of wood he can assign each ring to its proper year, provided he knows where the tree grew and has other trees of known age and the same species with which to compare it. He does this by a minute study of the relative thickness and general characteristics of adjacent groups of rings. It seems almost incredible that such high accuracy is possible, but there can be no doubt that the method is successful. In this way he has checked up the reviewer's long series of measurements of the sequoias in California and has found that in spite of minor errors the general curve of climatic pulsations derived from a study of the big trees is correct.

Other parts of Professor Douglass' book are devoted to the correlation of the tree curves with the rainfall and with sun spots, and to a study of cycles. In addition, an important section describes methods of "periodic analysis." By the means of a periodograph of his own invention the author is able to analyze any sort of curve and find what periodicities it shows. This is done by photographing the plotted curve through a fine grating. If there is no periodicity the photograph assumes a hazy or dotted appearance. If there are periodicities, a series of parallel lines appears.

The chief results of Professor Douglass' work may be summed up as follows:

(1) He has developed a unique method and a highly perfect technique for the study of tree growth.

(2) He has shown conclusively that there is a close relation between the thickness of the rings of growth and the climate. This relation varies greatly from region to region, but the relationship can readily be worked out if sufficient data are at hand.

(3) He has shown that the tree records covering centuries agree with meteorological records covering decades in showing that the rainfall of different regions varies in opposite directions. This may happen even when places are only a few hundred miles apart, as on the eastern and western sides of the Scandinavian Peninsula.

(4) Professor Douglass has also shown that many of the curves of tree growth show a distinct correlation with changes in the number of sun spots. This is particularly marked in central and northwestern Europe.

(5) He finds a great number of cycles which he tabulates as follows:

5 to	6 years,	approximate half	sunspot period
10 "	13 "	" full	" "
21 "	24 "	" double	" "
32 "	35 "	" triple	" "
100 "	105 "	" triple-triple	" "

The chief criticism of Professor Douglass' work is that he perhaps overestimates the regularity of cycles. There can be no question as to the existence of cycles and as to their importance. To the reviewer, however, the cycles seem to be so irregular that it may be doubtful whether we are justified in assigning any exact periodicity.

ELLSWORTH HUNTINGTON

THE OFFICIAL YEAR BOOK OF AUSTRALIA

G. H. KNIBBS. **Official Year Book of the Commonwealth of Australia, Containing Authoritative Statistics for the Period 1901-1918 and Corrected Statistics for the Period 1788 to 1900.** No. 12, 1919. xxxviii and 1234 pp.; maps, diagrs., index. Commonwealth Bureau of Census and Statistics, Melbourne, 1919. 9½ x 6½ inches.

The practice of the Commonwealth governments of Australia and New Zealand of publishing official yearbooks in which the current results of a number of government bureaus are recorded gives these publications a special value to the investigator. In the case of Australia the Bureau of Census and Statistics is the coördinating agency. In its latest pub-